

REMARKS/ARGUMENTS

I. Concerning the Rejection under 35 USC 112

Claims 19, 23-25 and 30 stand rejected under 35 USC 112, first paragraph, as failing to comply with the written description requirement. Examiner's position is that the limitation "less than about 9 weight percent of water" is not supported by the specification.

To satisfy the written description requirement, a patent specification must describe the claimed invention in sufficient detail that one skilled in the art can reasonably conclude that the inventor had possession of the claimed invention. The subject matter of the claim need not be described literally (i.e., using the same terms or *in haec verba*) in order for the disclosure to satisfy the description requirement.

Several examples of Applicants' specification have a water content in the lean stream of the absorber of less than about 9%. For example, see Tables 2, and 4-8. Example 10 shows a water content of 8.6 weight percent. The number 8.6 mathematically rounds up to the number 9. Thus, one skilled in the art can reasonably conclude that the inventors had possession of a claimed composition having a water content of less than about 9 weight percent.

Claims 19, 23-25 and 30 stand rejected under 35 USC 112, second paragraph, as being indefinite. Examiner's position is that the word "about" in Claim 19 renders these claims indefinite.

As to indefiniteness, the claims must apprise the skilled artisan of the scope of the claims so he can, with little or no experimentation, determine whether his activity infringes the claim, i.e the question is whether one of ordinary skill in the art, in view of the prior art and the status of the art, would be reasonably apprised of the scope of the invention.

Applicants submit that the term "about" is widely used in chemical patents and is understood by those skilled in the chemical arts. In the present case, the prior art does not come close to the 9% water limitation of Claim 19, and the term "about" can be given a reasonably broad interpretation. Breadth, however, is not indefiniteness.

II. Concerning the Rejection under 35 USC 103(a)

Applicants acknowledge the withdrawal of all prior art rejections made in the prior Office Action.

Claim 19 stands rejected under 35 USC 103 as being obvious over Bedell in view of Landeck et al. (hereinafter Landeck).

Applicants' pending claims are directed to compositions and processes useful for selective removal of COS from gas streams. Claim 19 is directed to a composition comprising a specified pyrimidinone compound and at least one alkanolamine compound of formula II or a piperazine compound of formula III. The composition of Claim 19 comprises less than about 9 weight percent of water.

Bedell addressed the problem of finding an improved inhibitor compound to inhibit the oxidation of sulfites in systems where SO₂ is being removed from a gas stream. Bedell's inhibiting cationic polyelectrolytes are chosen from water soluble polymers containing quaternary amine groups. Bedell discloses the addition of 1-3000 ppm of water-soluble, polymeric cationic electrolytes to sulfite-containing aqueous alkali scrubbing solutions that contain amines selected from a very large group of compounds, including amines such as piperazines and pyrimidinones. In summary, Bedell does not disclose a process for the selective removal of COS using a solvent having a low amount of water.

Examiner acknowledges that Bedell does not teach compositions having a water content of less than about 9 weight percent. (As stated in Applicants' prior response, the *minimum* percent water in an aqueous piperazine/water system is likely to be about 25% by weight.)

Landeck discloses heterocycle-containing physical solvent compositions for removal of sulfur from gases. The heterocyclic compound can be selected from a very large number of such compounds. At col. 7, line 45, Landeck discloses that one of the members of the large class of compounds is 1,3-dimethyl pyrimidinane-2-one. However, according to Applicants' understanding, Landeck does not disclose piperazines. Landeck does not disclose a process for the selective removal of COS using a solvent composition that is a combination of a physical solvent and a chemical solvent, the composition having a low amount of water.

Examiner notes that Landeck teaches that the water content of his physical solvent preferably is "as little as possible," such as at most 5 wt.%, and that the related advantage of that is that an earlier water removal step is not necessary. Examiner concludes that it would have been obvious to minimize the amount of water in Bedell to achieve the advantage of Landeck.

However, one of ordinary skill in the art would not think that one could workably use a low amount of water with a chemical solvent, i.e. one skilled in the art would not consider Examiner's hypothetical combination. Landeck itself, at col. 1, lines 55-65, recognizes that chemical solvents require fairly large amounts of water for chemical gas treating agents. There is no teaching in Bedell regarding a chemical gas treating agent composition having less than 9 weight percent water. Therefore, Applicants submit that Claim 19 is not obvious over Bedell in view of Landeck, as neither

reference teaches or suggests the selective removal of COS using a solvent composition that is a combination of a physical solvent and a chemical solvent, the composition having a water content of less than about 9 weight percent.

Claims 19-20 and 23-30 stand rejected under 35 USC 103 as being obvious over Wagner et al. (hereinafter Wagner) in view of Bedell, further in view of Landeck.

Examiner's rationale is similar to that of the rejection addressed hereinabove, namely, that Wagner and Bedell do not teach the use of low amounts of water, but Landeck does; therefore, it would have been obvious to use low amounts of water in Wagner to achieve the above-described advantage of Landeck.

Wagner discloses a process for "selectively" removing COS from a hydrocarbonaceous fluid stream using an at least 30% water-containing aqueous amine solution containing various activator compounds. At col. 5, lines 29 et seq., Wagner states that the activator is advantageously a primary or secondary alkanolamine or certain heterocyclic compounds such as piperazine, methyl piperazine, and morpholine. Wagner does not disclose the use of the pyrimidinone compound of Applicants' claims. As discussed hereinbelow, Wagner does not disclose a process for the selective removal of COS. In summary, Wagner does not disclose a process for the selective removal of COS using a solvent composition that is a combination of a physical solvent and a chemical solvent, the composition having a low amount of water.

As mentioned hereinabove, Bedell teaches the use of solutions that contain amines selected from a very large group of compounds, including certain amines such as piperazines and pyrimidinones in chemical solvents for SO₂ removal processes. Bedell does not disclose a process for the selective removal of COS using a solvent composition that is a combination of a physical solvent and a chemical solvent, the composition having a low amount of water.

Landeck discloses heterocycle-containing physical solvent compositions for removal of sulfur from gases. The heterocyclic compound can be selected from a very large number of such compounds. At col. 7, line 45, Landeck discloses that one of the members of the large class of compounds is 1,3-dimethyl pyrimidinane-2-one. Applicants' understanding is that Landeck does not disclose the use of compounds of type b) of Applicants' claims, i.e. does not disclose alkanolamine compounds of Applicants' Claim 20, formula II, or piperazine compounds of Applicants' Claim 20, formula III. Landeck, as indicated by Examiner, teaches that the water content of his physical solvent preferably is "as little as possible," such as at most 5 wt.%, and that the advantage of that is that an earlier water removal step is not necessary. Landeck does not disclose a process for the

selective removal of COS using a solvent composition that is a combination of a physical solvent and a chemical solvent, the composition having a low amount of water.

None of the references disclose a process for the selective removal of COS using a solvent composition that is a combination of a physical solvent and a chemical solvent, the composition having a low amount of water. The reason for this is explained in Landeck. Specifically, Landeck, at col. 1, lines 55-65, recognizes that chemical solvents require fairly large amounts of water for chemical gas treating agents. Applicants submit that it would not be obvious, in view of art that teaches that high amounts of water are required with chemical solvents, to use a solvent composition that is a combination of a physical solvent and a chemical solvent, the composition having a low amount of water, to selectively remove COS from a gas stream.

Examiner argues that Bedell teaches that piperazines and pyrimidinones are “functional equivalents.” While this may or may not be true for SO₂ removal, which is the problem addressed by Bedell, Bedell teaches nothing about the equivalence of piperazines and pyrimidinones for selective COS removal. There is no teaching in the art to suggest that there would be a reasonable expectation of success associated with using a solution that is known to remove SO₂ in order to selectively remove COS.

Examiner argues that, since Bedell allegedly teaches that piperazine and pyrimidinones are functional equivalents for SO₂ removal, it would be obvious to replace the piperazine of Wagner with the pyrimidinones of Bedell in order to obtain a solution of aliphatic alkanolamine plus pyrimidinone useful to selectively remove COS in view of Landeck’s teaching that compounds such as pyrimidinones can be used to selectively remove COS. Applicants submit that this allegation is not supported by the prior art, namely, the fact that 2 compounds are known to remove SO₂ does not indicate that either or both of those compounds would selectively remove COS. Furthermore, as discussed hereinbelow, Wagner does not actually teach selective COS removal.

Examiner argues that Wagner discloses a process for “selectively” removing COS from a hydrocarbonaceous fluid stream. It is true that Wagner uses the word “selective” in connection with COS removal. In fact, however, Wagner discloses a process for *indiscriminately* simultaneously removing essentially equal amounts of COS and CO₂, from hydrocarbon fluid. See, e.g., Wagner at col. 4, lines 48-65, where Wagner states as follows: “... the use of an aqueous amine solution containing from 0.4 to 1.7 mol/l of a primary or secondary amine as activator provides a substantially unspecific removal of CO₂ and COS. At mandated processing parameters, therefore, the same percentage of CO₂ and COS is removed.” (Emphasis supplied.) In addition, see, e.g., Figure 5 of Wagner, which confirms the latter statement of Wagner. Thus, Wagner’s use of the term “selective” appears to be somewhat different than the normal definition, since removing the *same amount* of 2

materials from a mixture is not considered by one skilled in the art to be “selective” removal. Rather, “selective” in the chemical process sense means that a process “selects” one compound versus others. Despite the fact that Wagner uses the term “selective,” it is clear from reading the entire specification of Wagner that his process is *not* selective, and Wagner admits that his process is unspecific and not selective, e.g. in the passage cited hereinabove.

As stated hereinabove, Applicants’ claims are directed to compositions and processes useful for selective removal of COS from gas streams. The data in Applicants’ specification demonstrate some embodiments of the invention. For example, Comparative Example 89 at page 19 is similar to what is taught in Landeck. It shows that 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone (hereinafter DMTP) alone is not very effective, as it absorbs only 3.6% of the COS. In contrast, Example 10 shows that DMTP plus 3% diethanolamine (DEA) removes 40.1% of the COS. Example 14, at page 23, shows that DMTP plus 3% hydroxyethylpiperazine removes 69% of the COS. Example 15, at page 23, shows that DMTP plus 3% NMEA removes 100% of the COS. These results are not suggested by the prior art, and Applicants submit that the prior art does not support a prima facie case of obviousness.

Should Examiner still believe that the art supports a prima facie case of obviousness, then Applicants submit that the processes and compositions of the invention produce surprisingly good selectivity of COS removal. Selectivity, as defined by Wagner, is the percent COS removed divided by the percent CO₂ removed. Wagner’s “selectivity” values are approximately 1, i. e. Wagner’s process is not selective, as admitted by Wagner and as explained hereinabove. Applicants’ specification at Tables 1 and 8 contains data that allows one to calculate the selectivity, using Wagner’s definition of selectivity, of Applicants’ claimed process and compositions. Specifically, the last line of Table 1 shows that a solvent that is 1,3-dimethyl-3,4,5,6-tetrahydro-2(1H)-pyrimidinone (hereinafter DMTP) and 3% diethanolamine has a selectivity for COS that is $40.1/0.6 = 66.8$. Table 8 summarizes the results of Examples 14 (DMTP + 3% hydroxyethyl piperazine) and 15 (DMTP + 3% methylethanolamine). For Example 14 the selectivity is $69/6 = 11.5$, and for Example 15 the selectivity is $100/10 = 10$. These selectivities are all surprisingly far greater than Wagner’s alleged “selectivity” of approximately 1.

For the foregoing reasons, Applicants’ respectfully submit that Applicants’ claims are not obvious over Wagner in view of Bedell further in view of Landeck.

III. Conclusion

For the foregoing reasons, reconsideration of the claims and passing of the application to allowance are solicited.

Respectfully submitted,

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